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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,603	07/15/2003	Naoki Matsumoto	010986.52600US	5348

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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 03/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/618,603

Applicant(s)

MATSUMOTO ET AL.

Examiner

Rakesh K. Dhingra

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-17, 19, 20, 22, 23, 25, 26, 41 and 42 is/are pending in the application.
- 4a) Of the above claim(s) 26, 41 and 42 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-17, 19, 20, 22, 23 and 25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 14-17, 19, 20, 22-25 and 27 have been considered but are moot in view of the new ground(s) of rejection as explained below:

Applicant has amended claim 14 by adding limitation "and the top plate has a plurality of holes for passing a gas to be supplied to the process chamber". New reference by Shan et al (US Patent No. 5,948,168) has been found which when combined with Glukhoy, reads on the limitations of claim 14. Accordingly claim 14 and dependent claims 15, 25 have been rejected under 35 USC 103 (a) as explained below.

Further claims 19, 20, 22, 23 have also been rejected under 35 USC 103 (a) as explained below.

Claims 26, 41 (old claim 18) and Claim 42 (old claim 21) have been withdrawn (in line with previous office action) as pertaining to non elected species.

Terminal Disclaimer

The terminal disclaimer filed on January 23, 2006 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of pending application number 10/618,602 has been reviewed and is NOT accepted.

An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c).

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In the present case, the terminal disclaimer has been signed by Christopher T.

McWhinney, who as per this office records is not an attorney of record for the present application 10/618,603.

It would be acceptable for a person, other than a recognized officer, to sign a terminal disclaimer, provided the record for the application includes a statement that the person is empowered to sign terminal disclaimers and/or act on behalf of the organization.

Accordingly, a new terminal disclaimer which includes the above empowerment statement will be considered to be signed by an appropriate official of the assignee. A separately filed paper referencing the previously filed terminal disclaimer and containing a proper empowerment statement would also be acceptable.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not

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commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 14, 15, 25 are rejected under 35 U.S.C. 102(e) as being unpatentable over Glukhoy (US patent No. 6,783, 629) in view of Shan et al (US Patent No. 5,948,168).

Regarding Claim 14: Glukhoy teaches a plasma processing apparatus (Figures 1-3, 6, 7) for supplying microwaves into a process chamber 200 so as to generate plasma P to thereby treat an object W to be processed with the plasma;

wherein the process chamber 200 comprises a top plate 36 and a chamber wall

70 for defining the process chamber; and the chamber wall has at least one

antenna 206, 208 so that the antenna penetrates the chamber wall into the

inside of the process chamber; and the antenna is disposed in the inside of the

process chamber with respect to the top plate (Column 5, lines 15-35 and Column 6, lines 10-30 and Column 8, lines 20-45).

Glukhoy does not teach top plate with plurality of holes for passing a gas to be supplied to the process chamber.

Shan et al teach a microwave plasma apparatus (Figure 1A) that comprises a microwave generator 45, a waveguide 40 and vacuum chamber 10 that has plurality of holes in ceiling (top wall) for passage of gas into the chamber (Column 3, lines 20-45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus of Glukhoy so as to use chamber top plate with plurality of holes for gas supply as taught by Shan et al in the apparatus of Glukhoy to

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enable use more power for processing and generate efficient plasma (Column 4, lines 5-25).

Regarding Claim 15: Glukhoy teaches that the antenna comprises antenna tubes 208a...208n (voltage-drawing rod) for drawing a voltage from a waveguide or resonator 230 disposed outside of the process chamber; and an insulating material 206a...206n surrounding the voltage-drawing rod (Column 8, lines 25-45).

Regarding Claim 25: Shan et al teach that apparatus comprises a pedestal (susceptor) 15 for supporting the wafer (object) 20 to be processed is disposed in the process chamber 10, and a bias (through RF source 25) is applicable to the susceptor (Figure 1 and Column 3, lines 20-30).

Claims 16, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Glukhoy (US Patent No. 6,783,629) in view of Shan et al (US Patent No. 5,948,168) as applied to Claim 14 and further in view of Tsuchihashi et al (US Patent No. 6,109,208).

Regarding Claim 16: Glukhoy in view of Shan et al teaches all limitations of the claim except shape of antenna.

Tsuchihashi et al teach a plasma apparatus (Figure 1) for supplying microwaves (microwave oscillator 2) into a process chamber 1 to thereby treat an object to be processed with the plasma. Tsuchihashi et al further teach that at least one antenna 9a is disposed in the process chamber so as to provide a linear and/or curved line and that uniformity of plasma can be improved by combining the antenna structures as necessary (Figures 1, 4, 5 and Column 8, lines 40-50).

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Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use antenna configurations as taught by Tsuchihashi et al in the apparatus of Glukhoy in view of Shan et al to improve plasma uniformity.

Regarding Claim 22: Glukhoy teaches all limitations of the claim except movement of antenna. Further, Tsuchihashi et al teach that the plasma apparatus (Figure 10) has means for moving the antenna 9 (voltage driving rod) in the processing vessel 1 (Column 3, lines 58-60 and Column 10, lines 1-5).

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Glukhoy (US Patent No. 6,783,629) in view of Shan et al (US Patent No. 5,948,168) as applied to Claim 15 and further in view of Wartski et al (US Patent No. 5,637,150).

Regarding Claim 17: Glukhoy in view of Shan et al teaches all limitations of the claim except length of voltage drawing rod (antenna).

Formula given in the claim: $\{(1=2m)/2\} \lambda_{\text{sub.g}} \pm (1/4) \lambda_{\text{sub.g}}$ when solved for integer value of m as 1, gives length of antenna as $5/4 \lambda_{\text{sub.g}}$ and $7/4 \lambda_{\text{sub.g}}$ which are odd multiples of a quarter of the guide wavelength. For other values of integer also, the antenna length would result in odd multiples of a quarter of wavelength.

Wartski et al teach a microwave plasma apparatus (Figure 1) that includes a plurality of metal antennas 5 disposed inside chamber 4 and where the length of antenna is $k \cdot \lambda / 4$ where k is an odd multiple and λ is the wavelength (Column 2, lines 40-65 and Claim 2).

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Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use antenna length as taught by Wartski et al in the apparatus of Glukhoy in view of Shan et al to enable optimum coupling of microwave energy with the plasma chamber.

Claims 19, 20, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Glukhoy (US Patent No. 6,783,629) in view of Shan et al (US Patent No. 5,948,168) as applied to Claim 15 and further in view of Minaee et al (US Patent No. 6,558,635).

Regarding Claims 19, 20, 22: Glukhoy in view of Shan et al teaches all limitations of the claims except tuner and moving of the voltage drawing rod to enable variable coupling between plasma and waveguide.

Minaee et al teach an apparatus (Figure 3) that has means for moving antenna 19 (voltage drawing rod) to enable match impedance between waveguide 26 and plasma chamber 11 (Column 4, lines 55-62 and Column 5, lines 35-42). Minaee et al further teach that the apparatus has tuning rods 35 and plate 28 for adjusting and tuning the waveguide 26 to enable antenna 19 deliver the energy to plasma chamber 11.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use tuning and moving means of antenna as taught by Minaee et al in the apparatus of Glukhoy in view of Shan et al to match the impedance of the waveguide with the plasma.

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Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Glukhoy (US Patent No. 6,783,629) in view of Shan et al (US Patent No. 5,948,168) as applied to Claim 14 and further in view of Totonani et al (US Patent No. 6,181,069).

Regarding Claim 23: Glukhoy in view of Shan et al teaches all limitations of the claim except measuring device to monitor the plasma.

Totonani et al teach a plasma apparatus (Figure 14) that comprises antennas 45, 46 and further has a probe 54 (measuring device) disposed above quartz window 44 (top plate) to measure the luminous intensity of plasma (Column 13, lines 5-10).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a measuring device as taught by Totonani et al in the apparatus of Glukhoy in view of Shan et al to monitor the state of plasma.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Li et al (US PG PUB No. 2003/0127191) teach plasma apparatus (Figure 1) that has a chamber 11 and where plurality of gas diffusion holes gas 32 are formed in the top wall of the chamber (Paragraph 0095).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone

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number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Rakesh Dhingra


Parviz Hassanzadeh
Supervisory Patent Examiner
Art Unit 1763